MODELLING TRACEABILITY OF KTMB TRAIN PASSENGER

ABDUL HADI BIN HASHIM

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Faculty of Mechanical and Manufacturing Engineering
Universiti Tun Hussein Onn Malaysia

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For my beloved mother Salasiah Binti Mat Koris, father Hashim Bin Zahari, and wife Norhayati Binti Ishak

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ABSTRACT

The main objective of this study was to develop a model for traceability of train passengers. To achieve this objective, KTMB as a main national railway operator had been used as a model for study. As there are many different types of rail passenger transport services provided by KTMB, Ekspress Rakyat 1 & 2 had been selected to serve as a model. Basis of this study was that there are no such models ever developed for the existing railway system. The scope of the research was focused between KL Sentral and Ipoh Station only. The software used to create the model was ARENA Simulation Software (student version). ARENA software was also able to create simulations and animations that were used in this study. Due to data provided by KTMB was too general, interview with staff of KTMB like training managers, station managers, trainers and drivers has been done to obtain more detailed information. As a result, Modelling Traceability of Train Passenger was managed to develop. The simulation results show that there are certain things that need to be addressed by the KTMB. Among the things, there are stations which had high volatility passengers. There are also stations which has a number of passengers who boarded the train more than come down from the train at the same station. In addition, there are also stations which show the number of passengers who boarded the train in the opposite direction more than the other way around. With this model, it’s hoped it will help the KTMB improve their passenger rail services. In addition, this model can also be used as a guide for researchers in the future.

ABSTRAK

Objektif utama kajian ini dijalankan adalah untuk menghasilkan satu model untuk mengesan penumpang keretapi. Ke arah mencapai matlamat ini, KTMB selaku peneraju utama sistem pengangkutan keretapi negara telah dipilih untuk dijadikan model kajian. Memandangkan terdapat banyak jenis perkhidmatan keretapi pengangkutan penumpang yang disediakan oleh KTMB, Ekspress Rakyat 1 & 2 telah dipilih untuk dijadikan model. Asas kajian ini dijalankan ialah kerana tidak terdapat model yang sebegini pernah dihasilkan untuk sistem keretapi sediada. Skop kajian pula dihadkan antara Stesyen KL Sentral hingga Ipoh sahaja. Perisian yang digunakan untuk membuat model ini ialah ARENA (versi pelajar). Perisian ARENA ini juga mampu membuat simulasi beserta animasi yang turut digunakan dalam kajian ini. Disebabkan data yang diberikan oleh KTMB terlalu umum, temubual bersama staf-staf KTMB seperti pengurus latihan, pengurus stesyen, pelatih serta pemandu telah dilakukan bagi mendapatkan maklumat yang lebih terperinci. Hasil daripada itu, model pengesanan penumpang keretapi KTMB ini berjaya dihasilkan. Keputusan simulasi menunjukkan terdapat beberapa perkara yang perlu diberi perhatian oleh pihak KTMB. Antaranya, terdapat stesyen yang mempunyai kadar turun naik penumpang yang tinggi. Terdapat juga stesyen yang mempunyai bilangan penumpang yang naik lebih ramai berbanding yang turun di stesyen yang sama. Selain itu, terdapat stesyen yang mempunyai perbezaan jumlah penumpang turun naik yang agak ketara mengikut arah perjalanan di stesyen yang sama. Dengan adanya model ini, diharapkan ia dapat membantu pihak KTMB menambahbaik sistem perkhidmatan keretapi penumpang mereka. Selain itu, model ini juga boleh dijadikan sebagai panduan kepada penyelidik di masa akan datang.

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CHAPTER 1

INTRODUCTION

1.1 General background

In many countries both developed and developing, the railway system plays an important role in many things. Now it looks like there was a race in railway technology where some developed countries including China makes huge investments to create the latest technology that relies on speed and comfort of each rail system. According to reports the railway industry, today's fastest passenger facilities and the latest was a high speed domestic train in China. But each country proud with their HST and continuously strive to improve their train.

In Malaysia, as a developing country, railway system plays an important role towards achieving Vision 2020. The railway system was used not only for passengers but also for the transportation of goods. Therefore, a good rail transport systems must be developed to keep up with demand and the rapid development towards year 2020. Malayan Railway was the main railway operator in Peninsular Malaysia. Formerly it was known as an agency under the Malayan Railway Administration, and then now known as KTMB following the effects of corporatization of government-led campaign in 1992. However, KTMB was still wholly owned by the federal government. The history of coach system began during the British colonial era, when the railway was originally built to transport tin. The train fare was quite reasonable, but speed Intercity trains (intercity) lower in narrow path often leads KTMB transport less competitive compared to other modes of transportation.

Despite all the efforts and improvements has been made since it was established, the fact that passengers were still plagued with the same problems of timeliness to the railway station. KTMB while also still faced similar problems of passengers boarded the train without a ticket but safely reach their destinations.

So, this project was study the current train passenger traceability and identifies the opportunity of improvements. Parameters such as utilization, working time, schedule deviation, number of passengers and ticketing system has been use. The others factor such as time of fluctuate passengers, peak time of service and load capacity of power source has been considered.

Traceability was defined as the degree to which a relationship can be established between two or more products of the development process, especially products having a predecessor–successor or master–subordinate relationship to one another; for example, the degree to which the requirements and design of a given software component match [1]. Traceability implies keeping track of the relationships between requirements, design artifacts, source code, test cases, etc. [1].

1.2 Problem statement

According to KTMB Annual Report 2012, the 2012 revenue for ETS had shown an increase of 33.5% from RM23.9 million to RM31.9 million. The number of passengers also increased to 33.3% from 0.9 million in 2011 to 1.2 million in 2012. KTM Intercity was expected an increase in revenue and ridership should the level of service especially in the area of punctuality can be improved.

Despite the increase of the ETS revenue and the number of passenger, KTM Intercity revenue in 2012 showed a decrease of 11.1% compared to 2011 which is from RM91.8 million in 2011 to RM81.6 in 2012. The number of passengers for the year 2012 recorded a ridership of 3.1 million compared to 3.7 million in 2011 which is a 16.2% reduction. However, the ETS had shown greater improvement overall since the service was introduced in August 2010.

Looks at this situation, something should be done on KTM Intercity train service (Normal Train). The main focus was to improve in terms of the ridership. What can be done to convert a decrease of 16.2% to an increase of 16.2%. It was because the issue of timeliness to catch a train. Or community trust issues on trains. Or the problem of passengers traceability before, during and after boarded the train.

Results of interviews with KTMB staff shows; there was no existing model in KTMB to track passenger travel in terms of passenger numbers fluctuate from station to station. Therefore, the study on the current train passenger traceability system should be implement to see either there are opportunity of improvements to be done or not. Then, develop the model for traceability of KTMB ridership.

1.3 Objective

The objectives of this project are:

i. To identify the opportunity of improvements in terms of passenger traceability.
ii. To develop the model for traceability of KTMB ridership.

1.4 Scope

i. The train route to be study was between Ipoh and KL Sentral.
ii. Only two model of KTM Intercity (Normal Train) to be studies which are Ekspres Rakyat 1 and Ekspres Rakyat 2.

1.5 Significance of study

Identify the opportunity of improvement to model the traceability of the ridership for KTMB Intercity (Normal Train). Its can help KTMB itself to simulate the forecast of ridership using that model. It also can be used by other rail operator to simulate their ridership and also for future research as a guide.

CHAPTER 2

LITERATURE REVIEW

In this chapter, a number of articles related to traceability systems in general and of railway passengers in particular has been reviewed. First, description and operating system of Keretapi Tanah Melayu Berhad (KTMB) were explained. Then, the reviewed on the related previous articles were discussed includes the articles about railway ticket system in general and of current system at Malaysia in particular and also the articles about RFID, bar code system and GPS were discussed.

2.1 DESCRIPTION OF KERETAPI TANAH MELAYU BERHAD (KTMB)

Keretapi Tanah Melayu Berhad (KTMB) was the largest railroad in the country. Their mission is to be the preferred land transportation system by provided safe, efficient and reliable integrated rail services for people and goods.

Figure 2.1: Sample of KTMB's Intercity Trains

The first railway track in Malaysia was built in 1885. This was a 12.8 km length of road from the tin mining town of Taiping to Port Weld known today as Kuala Sepetang [11,12]. This was followed by the establishment of the Keretapi Tanah Melayu (KTM) in 1946 before it was privatized in 1992 and known as the Keretapi Tanah Melayu Berhad (KTMB) [12]. Figure 2.1 shows the sample of KTMB's Intercity Trains. Railway service over 100 years old has gone through many changes. Starts with coal locomotives, diesel engines and diesel power, to our commuter service using electricity was first introduced in 1995. KTMB control 1791 km length, 1000 mm gauge railway network, 1655 km in Peninsular Malaysia [12]. It consists of two main lines which are West coast line and East coast line and several branch lines. Now, KTM offers four types of services include KTM Intercity, KTM Cargo, KTM Commuter and KTM Distribution. Figure 2.2 shows rail track for KTMB services which include KTM Intercity and KTM Komuter.

Figure 2.2: Rail track, stations and stops for KTM Intercity and KTM Komuter

In this project, the focus of the study was to KTM Intercity (Normal Train). Intercity train service was a service that was introduced by KTM since more than a decade ago. As introduce additional services to the people by give them choices in terms of diversity coach and travel destinations include Peninsular Malaysia. Change for change has been implemented to provide services in a comfortable and safe journey to your destination of choice in the shortest time possible. KTM managed multiple services under KTM Intercity brand. Most of these services operate from Station Kuala Lumpur Sentral. However, there was a train service only runs along the East Coast route between dense and Gemas and next headed to Singapore. There was a cross-border rail services operate between Butterworth and Bangkok, Thailand.

2.2 DESCRIPTION OF TRACEABILITY

Traceability has been defined variously. According to Ivan Santiago (2012) traceability was defined as the extent to which a relationship can be established between two or more of the product development process, especially products have a predecessor-successor or master-slave relationship to one another; for example, the extent of the requirements and design of software components given match. [1]. Traceability implies keeps track of the relationships between requirements, design artifacts, source code, test cases, etc. [1].

According to the International Standards Organizations (ISO8492: 1995), traceability was the ability to trace the history, application or location of an entity, by means of recorded identifications [9]. Several organizations and researchers have defined traceability further to their areas of considerations in the traceability, which are as follows [2]:

- "*The ability to follow or study out in detail, or step by step, the history of a certain activity or a process*" [13].
- "*Traceability is the ability to track a product batch and its history through the whole, or part, of a production chain from harvest through transport, storage, processing, distribution and sales or internally in one of the steps in the chain*" [14].

• “*Traceability is a concept relating to all products and all types of supply chain*" [15].

Proper traceability systems also have the potential to reduce the possibility of the supplier or suppliers responsible for product safety problems by provides your data was documented effect to prove that they comply with the requirements of law and not risk [2].

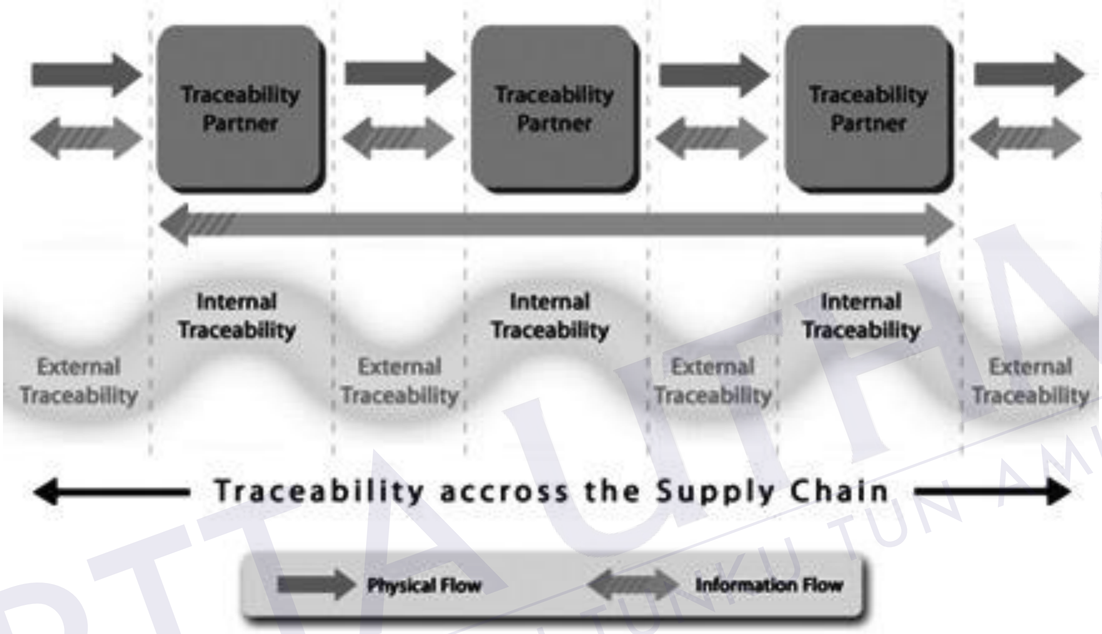

Figure 2.3: Traceability across the supply chain [10]

According to Yong-Shin Kang and Yong-Han Lee [5], traceability in logistics was the ability of participants to track products throughout the supply chain by means of either products and/or containers identifier in a backward and/or forward direction. In today's competitive economic environment, traceability was an important concept related to all products and all kinds of supply chains. To be more specific, it can provide companies the basic information required for the realization of supply chain optimization, product safety, better pond management, and better customer service [5].

In terms of manufacturing perspective, Nair and Shah [7] has defined traceability as knows what happens to the product through the manufacturing process - from initial raw materials to final product, including detailed information about operators who work on the product (or component built or mixed into the product), equipment and tools used in the manufacturing process, work that has been done, and had the status of production process control, among others [7].

2.3 DESCRIPTION OF RFID

RFID is an automatic identification field that has quietly been gaining momentum in recent years and is now seen as a way to radically improve data handling process, free in many ways to other data collection technologies such as bar coding. RFID stands for Radio Frequency Identification Device that holds a small amount of data that is unique; serial number or other unique attributes of the item. Data can be read from a distance of not having contact or line of sight necessary [6].

The largest use of RFID is to trace and consumer goods supply chain. Track shipment from the factory, containers in transit, unloading, the arrival of each package, looking at the shelf where the package is stored, it is suspended, out of stock, theft, light sensing RFID can detect if the container is opened [6].

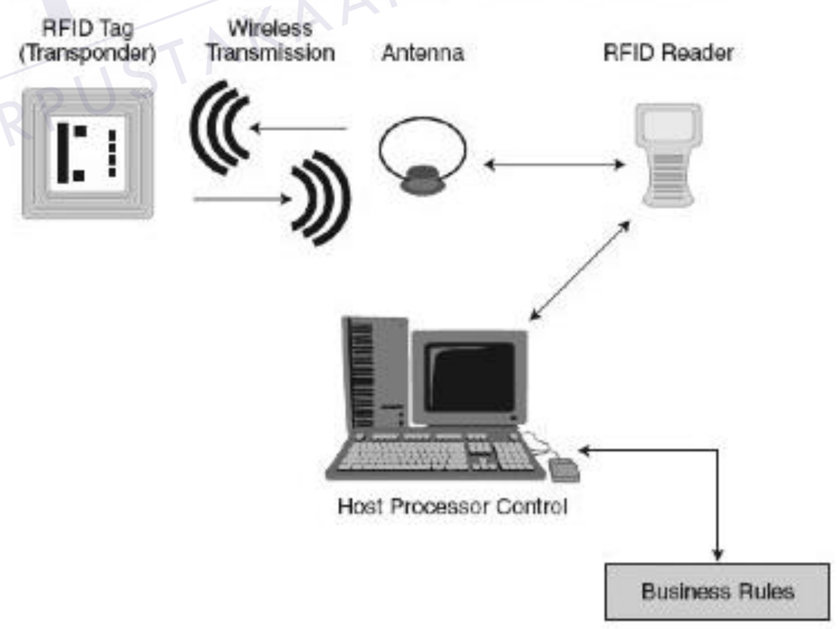

Figure 2.4: Basic diagram of RFID principle

2.4 DESCRIPTION OF GPS

GPS is stands for Global Positioning System. According to Dr. Subra (2007), GPS is a constellation of satellites orbiting the Earth that is retained by the United States Government to determine the geographical position at and above the Earth's surface. It consists of three segments which is user segment, control segment and space segment [6]. The first GPS satellite was launched in 1978 and full constellation achieved in 1994. This satellite built to last about 10 years and about 2,000 pounds, 17 feet across. The power of the transmitter is just 50 watts or less [6].

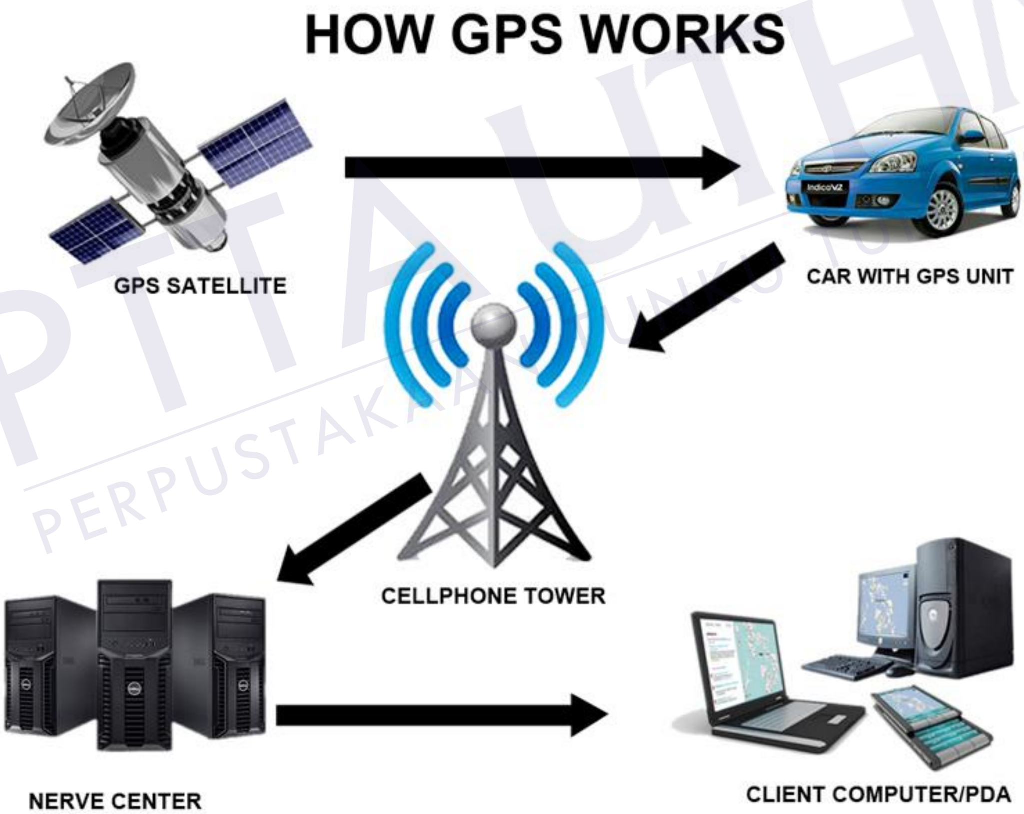

Figure 2.5: Sample diagram of GPS principle

2.5 TRACEABILITY SYSTEM INCORPORATING 2D BARCODE AND RFID TECHNOLOGY [3]

Based on article by Jian-Ping Qian and friends [3], 2D barcode can incorporate with radio frequency identification (RFID) technology to develop the Traceability System. They designed the encoding rules for the raw material, processing and traceability batches. Then, label with the Quick Response Code (QR Code) has been attached to a small package of products to connect them with their processing information, and RFID tag has been attached to the box to record information logistics. They develop a tracking system based on group identification and record keeping. The Traceability System management and detection capacity was assessed using contrast experiment. This experiment was divided into five parts, including recording of; raw material data, data processing, package data, logistics data and tracking inquiries. The results show that the system is dominant in the total consumption of five parts has been reduced by 113%, and accuracy of five parts, which increased by 8% min. QR Codes and RFID recognition accuracy was assessed using tests with different reading distance. Costs and income variations in application systems have been analyzed by the survey. Results showed that the total cost increased by 17.2% to apply the system. Compared with the cost, increase sales revenue is obvious, and it reached 32.5%. Given the good results of the assessment, the system has good potential in medium or large enterprise applications [3].

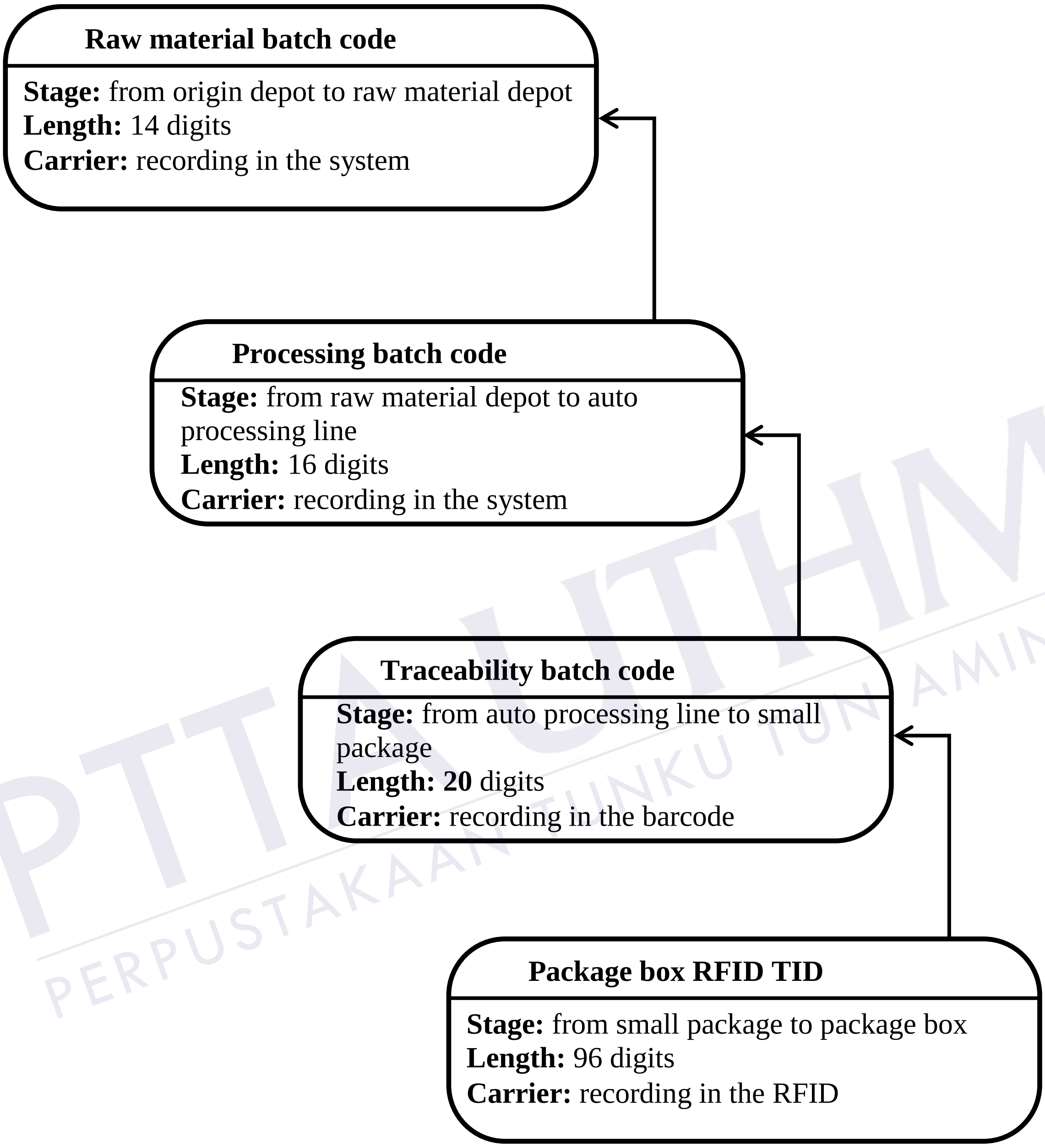

Figure 2.6: Different batch encodings for product traceability [3].

2.6 RFID-ENABLED TRACK AND TRACEABILITY IN JOB-SHOP SCHEDULING ENVIRONMENT [4]

From the study by Jongsawas Chongwatpol and Ramesh Sharda [4], the paper study about RFID-based traceability approach to improve production scheduling. This study was conducted to explore the option of scheduling enabled by RFID-based tracking system. Jongsawas and Ramesh proposes a visibility-based scheduling information (VBS) new rules that use information generated from real-time tracking system for work in process (WIPS) tracking, parts and components, and raw materials to adjust production schedules. Then they evaluate the performance of visibility-based visual information on classical scheduling rules. Simulation results show that RFID-based scheduling rule produces better performance compared to traditional scheduling methods with respect to the cycle time, machine utilizations, arrears, and penalty costs. Jongsawas and Ramesh also note that the value of the visibility of this information is more relevant when demand varies widely and/or operating interference caused [4].

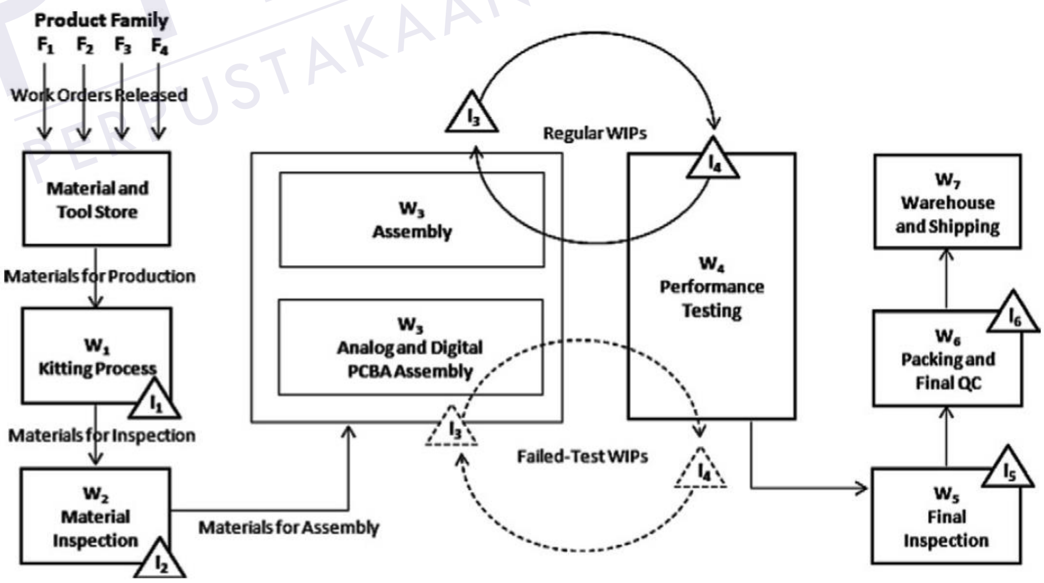

Figure 2.7: A logical flow of OPT manufacturing processes [4]

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